UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/642,358	08/15/2003	Michael Christopher Burl	EVOL.006A	1624

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EXAMINER
LAROSE, COLIN M

ART UNIT	PAPER NUMBER
2623	2

DATE MAILED: 03/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM
THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed
  after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
  earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☐ Responsive to communication(s) filed on _____.

2a) ☐ This action is **FINAL**.   2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is
closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-52* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☒ Claim(s) *1-18,27-49,51 and 52* is/are allowed.

6) ☒ Claim(s) *19-26 and 50* is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a) ☐ All   b) ☐ Some * c) ☐ None of:

      1. ☐ Certified copies of the priority documents have been received.

      2. ☐ Certified copies of the priority documents have been received in Application No. _____.

      3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage
application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
    Paper No(s)/Mail Date <u>23 December 2003</u>.

4) ☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____ .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in
> section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are
> such that the subject matter as a whole would have been obvious at the time the invention was made to a person
> having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the
> manner in which the invention was made.

2.   This application currently names joint inventors. In considering patentability of the

claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various

claims was commonly owned at the time any inventions covered therein were made absent any

evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out

the inventor and invention dates of each claim that was not commonly owned at the time a later

invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c)

and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3.   Claims 19-25 and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S.

Patent 5,109,425 by Lawton in view of U.S. Patent 5,838,828 by Mizuki et al. ("Mizuki").

Regarding claims 19 and 50, Lawton discloses a method/circuit for determining a

motional state of a mobile robot, the method comprising:

receiving pixel data for video images, where the video images are taken from a camera

mounted to the mobile robot (column 1, lines 17-20 and camera 24, figure 5);

processing the pixel data for the video image to identify amounts of spatial gradient

within a video image (column 1, lines 25-32: computational means for calculating spatial

gradients of the images); and

comparing the amounts of spatial gradient of a first image to the amounts of spatial

gradients of a second video image to detect the motional state of the mobile robot (column 1,

lines 32-39: temporal gradient between two images is computed and then used to determine the

movement of objects in the field of view, thereby ascertaining the movement of the mobile

robot).

Lawton does not disclose characterizing the pixels into two groups corresponding to

higher and lower spatial gradients and then using the characterization of the pixels for comparing

two different video images.

Mizuki discloses a process, similar to that of Lawton, for determining the presence of

motion in a video image. In particular, Mizuki discloses calculating the amounts of spatial

gradient of two video images (e.g. via a Sobel filter) and then characterizing the pixels of the

image into two groups based on the amount of spatial gradient for each pixel. This results in a

"binary edge bit map" whereby each pixel is assigned a value of 1 or 0 based on the amount of

spatial gradient (i.e. whether an edge is present). Column 6, lines 12-26.

After characterizing each pixel according to the spatial gradient, the resulting binary edge

bit maps are compared to determine the temporal gradients, which provide a measure of

movement between corresponding objects in each of the two images. Column 6, lines 27-48.

Thus, Mizuki and Lawton both disclose similar processes for determining the presence of

motion in successive video images: calculate the spatial gradient followed by the temporal

gradient. Mizuki teaches the additional step of binarizing the spatial gradient calculation prior to

the temporal gradient calculation. This extra binarizing step reduces the complexity of the

temporal comparison – only single bits are compared for each pixel rather than eight or more –

and achieves substantially the same results as Lawton's process in that the motion of objects

within successive video frames is calculated. For these reasons, it would have been obvious to

one skilled in the art to modify Lawton by Mizuki to characterize the pixels as claimed (i.e.

binarize the pixels) and then use the binary representation of the pixels for the subsequent

(temporal) comparison.

Regarding claim 20, Mizuno discloses arranging the pixels into a binary bit map as

claimed.

Regarding claim 21, Mizuno discloses the characterizing comprises comparing a binary

value for one pixel of the first image to a group of binary values for pixels of the second image,

wherein the group includes a pixel in the same location as the one pixel from the first image

(column 8, lines 41-49 and figure 6: for computing distortion values for the motion

measurements, the pixels of a present frame and compared to multiple pixels within a search

window of a reference frame).

Regarding claim 22, Mizuno discloses computing XOR values between the binary value

and the groups of values (column 10, lines 34-42).

Regarding claim 23, Mizuno discloses inspecting pixel data to evaluate whether enough

useful spatial gradients exist for robust detection of the motional state (114, figure 5A: there

must be enough edges present in order to determine the motion information); and

inhibiting a motional state of "not moving" at least partly in response to a determination

that the detection of the motional state is not likely to be reliable (124, figure 5B: if it is

determined that the motional state measurement is not reliable (i.e. there is high distortion), then

the image portion is not assigned a motion vector and no movement is assumed).

Regarding claim 24, Lawton discloses the motional state is determined only by analysis

of visual data observed by the camera 24 (i.e. there are no other types of sensors or the like for

collecting data for determining motion).

Regarding claim 25, Lawton's robot is autonomous (figure 5: planetary rover) and the

method is performed entirely within the robot (figure 5: machine vision system is contained in

the robot).

4.   Claim 26 rejected under 35 U.S.C. 103(a) as being unpatentable over Lawton in view of

Mizuki as applied to claim 19 above, and further in view of U.s. Patent Application Publication

2004/0017937 by Silverstein.

Regarding claim 26, Lawton discloses all of the image processing is performed within the

mobile robot. Lawton is silent to sending, performing, and receiving, as claimed.

Silverstein discloses a mobile robot that relies on image information for navigation

control. In particular, Silverstein discloses that image analysis may be performed within the

robot, or alternatively, image data may be transferred to a remote processor for analysis

(paragraph 39).

It would have been obvious to one skilled in the art to modify Lawton and Mizuki by

Silverstein to send image data to a remote computer, perform part of the pixel characterizing

operations in the remote computer, and then receive an indication of movement from the remote

computer, since Silverstein shows that image analysis for purposes of determining the motional

state of a robot is equivalently performed at remote locations rather than within the robot.

Allowable Subject Matter

5.   Claims 1-18, 27-49, 51, and 52 are allowed.

Regarding claim 1, the combination of Lawton and Mizuki teaches all of the claimed

features except using the comparison to count the number of pixel identified as unchanged,

comparing the count to a threshold, and determining the motional state partly in response to the

count.

Regarding claims 27, 45, 49, 51, and 52, Lawton's disclosure is directed towards

determining the motional state of a robot, but does not disclose the concept of comparing the

actual motional state to an intended motional state in order to change the behavior of the robot.

Conclusion

6.   The prior art made of record and not relied upon is considered pertinent to applicant's

disclosure.

U.S. Patent Application Publication 2003/0007682 by Koshizen et al.

U.S. Patent 4,628,453 by Kamejima et al.

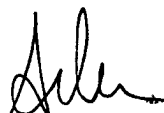U.S. Patent 4,969,036 by Bhanu et al.

"A Structure-from-motion Algorithm for Robot Vehicle Guidance" by Wang et al.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Colin M. LaRose whose telephone number is (703) 306-3489. The examiner can normally be reached Monday through Thursday from 8:00 to 5:30. The examiner can also be reached on alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au, can be reached on (703) 308-6604. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the TC 2600 Customer Service Office whose telephone number is (703) 306-0377.

AMELIA M. AU
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600

CML
Group Art Unit 2623
19 March 2004